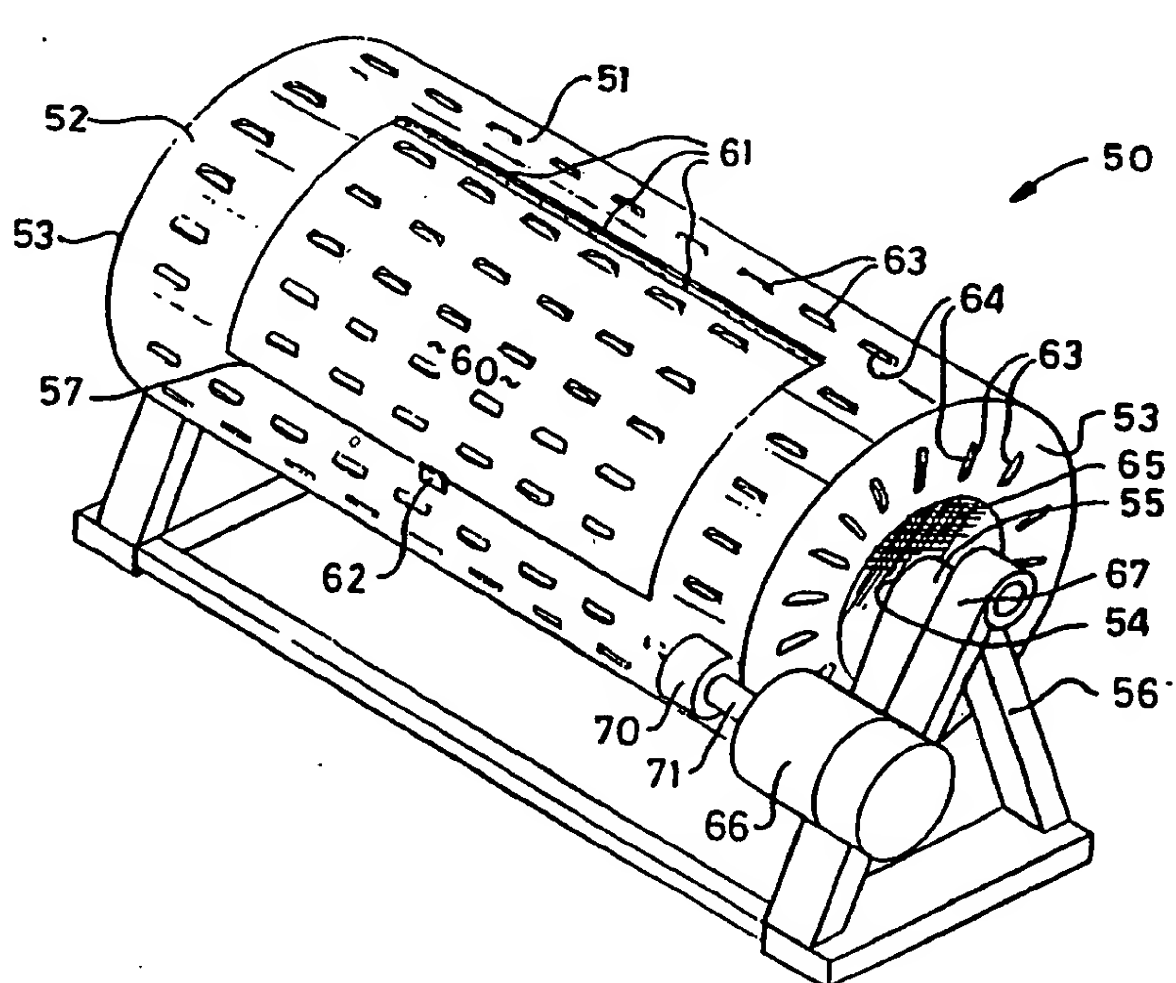




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: DRYING APPARATUS  (57) Abstract Drying apparatus (50) is disclosed in which a drying drum (51) with external louvers (63) formed in its periphery and mesh panels (65) formed in its end plates (53) is rotatable in bearings (55) about a horizontal axis. Rotation of the drying drum (51) induces an air flow between the external louvers (63) and the mesh panels (65), the air passing through textiles such as clothes or the like placed within the drying drum (51) through an access aperture (57), and also provides a tumbling action acting upon the textiles within the drying drum (51). The drying drum (51) is driven by an electric motor (66) through a friction-drive wheel (70) engaging with the outer periphery of the drying drum (51). The drum support frame (56) may be free-standing or may clamp to a balustrade, railing or the like.		

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"DRYING APPARATUS"

-- BACKGROUND OF THE INVENTION --

This invention relates to drying apparatus.

5 This invention has particular but not exclusive application to the drying of textiles, such as clothes, towels and the like, and for illustrative purposes reference will be made to such application. However, it is to be understood that this invention could be used in other applications, such as the dehumidification or aeration of
10 industrial materials.

-- DISCUSSION OF THE PRIOR ART --

Householders generally have a choice of two methods of drying washed clothes - they can be hung out to dry on a clothesline, or they can be dried in an electrically-heated
15 tumble dryer. Drying clothes on a clothesline in the sun has the advantages that it does not consume any electrical energy, and the exposure of the clothes to ultra-violet rays from the sun has a germicidal effect on the clothes. However, a significant amount of time must be spent on
20 hanging wet clothes on lines and on removing dried clothes from lines, and the clothes have a tendency to dry in stiff attitudes with obvious peg marks and creases. In addition, many householders, such as apartment dwellers, have no open space large enough to accommodate a clothesline.

25 If clothes are dried in a typical household drier, little time is required to load and unload the drier, and the dried clothes have a soft texture from the tumbling action. Considerable electrical energy is consumed in heating the clothes to evaporate the entrapped water, however, and there

is no exposure of the clothes to the germicidal effects of ultra-violet light.

-- SUMMARY OF THE PRESENT INVENTION --

5 The present invention aims to alleviate the above disadvantages and to provide drying apparatus which will be reliable and efficient in use. Other objects and advantages of this invention will hereinafter become apparent.

10 With the foregoing and other objects in view, this invention resides broadly in drying apparatus including:-

a drying drum rotatable about a drum axis and having a plurality of apertures formed in the drum shell whereby rotation of said drying drum about said drum axis induces an airflow through said drying drum;

15 support means for supporting said drying drum for rotation about said drum axis;

an access aperture formed in said drying drum, and drum drive means for rotating said drying drum about said drum axis.

20 Preferably the apertures include vent apertures which extend substantially radially away from and across the outer periphery of said drying drum for inducing an air flow through said drying drum, and the vent apertures constitute air inlet apertures adapted for inducing an air flow into the drum by their passage through the air stream as the drum rotates. Of course, if desired, other forms of inlet
25 apertures, including flat apertured portions of the drum shell, or portions of the drum shell formed of wire mesh, may be used such that air may enter the drum with minimal influence from drum rotational effects and whereby external
30 light, such as sunlight, may enter the drum. The drum may

also be provided with an external surface treatment or coating for enhancing its absorption of radiation such as infra-red light whereby solar heating of the drum may enhance the drying performance of the drying apparatus.

5 The outlet apertures may include vent apertures which extend substantially radially away from and across the outer periphery of said drying drum for adapted for inducing an air flow into the drum by their passage through the air stream as the drum rotates. Preferably, however, the outlet apertures
10 include flat apertured portions of the drum shell, or portions of the drum shell formed of wire mesh, whereby air may exit the drum with minimal influence from drum rotational effects.

 The drum may be formed in any desired shape, such as
15 spherical or oblate, but it is preferred that the drum be formed substantially cylindrical for ease of manufacture. The vent apertures may be formed as separately-moulded articles attached to the drum, but it is preferred that the vent apertures be formed in a ductile drum shell by shaped
20 louvres having their open sides substantially perpendicular to the direction of motion of the drum surface such that induction of air flow through the louvres is maximised.

 In an alternative embodiment, the drying drum is formed with mesh-like panels whereby air may circulate freely
25 between the inside and the outside of the drying drum and whereby external light may penetrate to the inside of the drying drum. Of course, if desired, other forms of drying drum may be used, such as drums having apertures formed within their surfaces. Perforated drums may be formed from
30 transparent material whereby light penetration may be enhanced.

 The support frame may be arranged such that the drum axis is held in any desired orientation. However, it is

preferred that the support frame is arranged whereby the drum axis is held substantially horizontal such that the tumbling action imparted to clothes as the drying drum rotates is enhanced. The support frame may be formed with ground-engaging legs, whereby the dryer apparatus may be self-supporting, and if desired, the support frame may be provided with wheels whereby the dryer apparatus may be movable easily along a surface. Alternatively, the support apparatus may be provided with rail mounting means for mounting to a rail or balustrade such that the dryer apparatus may be conveniently mounted on a balcony or veranda without occupying floor space.

The drying drum may be formed with aerodynamic fins formed on its surface such that rotation of the drying drum about its drum axis may induce air flow through the drying drum. The fins may project outward from the external surface of the drying drum such that air circulation is maximised, or the fins may project inward from the internal surface of the drying drum whereby exposure of householders to moving projections may be minimised. If desired, inwardly-projecting fins may be utilised for engaging with the clothes such that the latter may be carried around the drum, or the drying drum may be formed with internally-projecting paddles for engagement with the clothes.

Forced air circulation means, such as a fan may be provided if desired such that air flow through the drying drum may be enhanced, and heating means, such as an electric heater placed adjacent the inlet apertures, may be provided for enhancing the drying performance such as in conditions of low temperatures or high relative humidity.

The drying drum may be formed with an access aperture for placing clothes into and removing clothes from the drying drum, and the access aperture may be fitted with an access

door whereby the access aperture may be operatively sealed. The access aperture may be formed in an end wall of the drying drum, but it is preferred that the access aperture be formed in the peripheral wall of the drying drum such that convenient access is provided to the interior of the drying drum.

The access door may be formed of any desired material. Preferably, however, the loading door is formed of material similar to the material forming the peripheral surface of the drying drum whereby the access door may cause minimal reduction in air circulation and light input into the drying drum. The access door may be detachable from the access aperture for access to the interior of the drying drum, but it is preferred that it be hinged to the drying drum and that it be provided with a latch such that it may be held to the drying drum during its rotation. If desired, the access door may be biased into a desired position by biasing means such as a spring.

The drive means may be of any desired form, such as a solar-powered motor, whereby the drying apparatus may be self-contained. Preferably, however, the drive means includes an electric motor, and the electric motor drives the access drum through a friction wheel biased into engagement with the periphery of the drying drum by biasing means such as a spring. Alternatively, the drive means may include a reduction gearbox or a belt drive passing about a pulley attached to the drying drum or about the periphery of the drying drum, whereby a relatively low drum rotation speed is produced such that material placed in the drum may not be held to the drum by centrifugal forces, but may become detached from the drum during portion of a rotational cycle, whereby a tumbling action may be produced.

In another aspect, this invention resides broadly in

drying apparatus including:-

a support frame having a pivotal mounting formed thereon;

5 a drying drum supported on said pivotal mounting for rotation about a drum axis substantially coincident with the pivot axis of said pivotal mounting, said drying drum having vent portions thereof perforated by vent apertures,

an access aperture formed in said drying drum for access therein,

10 and

drive means for rotating said drying drum about said pivot axis.

In a further aspect, this invention resides in a method of drying clothes including:-

15 providing drying apparatus having a drying drum rotatable about a drum axis and having a plurality of air inlet apertures and a plurality of air outlet apertures formed in its drum shell whereby rotation of said drying drum about said drum axis may induce airflow through said drying drum
20 between said inlet apertures and said outlet apertures, support means for supporting said drying drum for rotation about said drum axis, and drum drive means for rotating said drying drum about said drum axis;

placing said drying apparatus in an outdoor location;

25 placing clothes within said drying drum,
and

operating said drive means whereby said drying drum is rotated.

-- BRIEF DESCRIPTION OF THE DRAWINGS --

30 In order that this invention may be more easily understood and put into practical effect, reference will now

be made to the accompanying drawings which illustrate a preferred embodiment of the invention, wherein:-

FIG. 1 is a front view of a drying apparatus according to the invention;

5 FIG. 2 is a partial section through a perforated drum according to another embodiment of the invention, and FIG. 3 shows a louvred drum drying apparatus according to the invention.

-- DESCRIPTION OF THE PREFERRED EMBODIMENTS --

10 The drying apparatus 10 illustrated in Fig. 1 has a support frame 11 with mounting clamps 12 formed on the lower ends of the frame uprights 13. The upper ends of the frame uprights 13 carry bearings 14. A perforated drum 15 is supported on stub axles 16 and 17 which are attached to the drum end plates 18 and are rotatable within the bearings 14. The perforated drum 15 has longitudinal fins 19 arranged around its periphery.

15 A loading opening 20 is formed in the peripheral surface 21 of the perforated drum 15, and a loading door 22 is hinged to an edge of the loading opening 20. The loading door 22 is provided with a latch 23 for holding it closed.

20 An electric motor 24 driving an integral reduction gearbox 25 is mounted on the end of the bearing 14, and the gearbox output shaft 26 is attached to the axle 16.

25 In use, the drying apparatus 10 is fixed to a handrail 27 by means of the mounting clamps 12, and the latch 23 is disengaged to open the loading door 22. The latter is then swung away from the loading opening 20, allowing clothes for drying to be placed within the perforated drum 15. The electric motor 24 is then energised, driving the gearbox 25 to turn the perforated drum 15.

30

As the perforated drum 15 rotates, air is drawn through it by the action of the longitudinal fins 19, and sunshine may enter through the perforations 28.

5 The perforated drum 40 illustrated in Fig. 2 has its peripheral surface 41 formed from curved aluminium sheets 42 which have louvres 43 pressed outward from them to form air collection fins and to provide open slots 44 for the circulation of air and the ingress of sunlight. Baffle plates 45 are attached to the peripheral surface 41 to assist
10 in tumbling clothes placed within the perforated drum 40.

The drying apparatus 50 shown in FIG. 3 includes a cylindrical drum 51 having a curved peripheral shell 52 and flat end plates 53 to the centres of which are attached stub shafts 54. The latter engage with bearings 55 attached to a support frame 56. A loading aperture 57 is formed in the
15 drum 51, and is closed with a loading door 60 pivoted to the drum 51 by door hinges 61 and held in a closed position by a door catch 62.

20 The shell 52, the loading door 60, and the outer peripheries of the end plates 53 have louvres 63 formed in them, the louvre intakes 64 being aligned perpendicularly to the direction of motion of the rotating drum 51. Wire mesh panels 65 form the inner portions of the end plates 53, although if desired perforated sheet panels could be used
25 instead.

An electric drive motor 66 is mounted on a motor platform 67 pivoted to the support frame 56, and carries a friction-drive wheel 70 on its drive shaft 71. The motor platform 67 is spring-biased to urge the friction-drive wheel
30 70 against an edge of the drum 51.

In use, the door catch 62 is released, permitting the loading door 60 to be opened such that damp clothes or the like for drying may be inserted into the drum 51. The

loading door 60 is closed, and the drive motor 66 energised. The friction-drive wheel 70 rotates the drum 51, inducing an air flow through the drum 51 between the louvres 63 and the mesh panels 65, and tumbling the clothes. These effects
5 combine to bring the clothes into close contact with a drying stream of air. If the drying apparatus 50 is placed in an exposed location, sunlight may enter the drum 51 through the louvres 63, imparting bleaching and germicidal treatments to the clothes therein.

10 It will of course be realised that while the above has been given by way of illustrative example of this invention, all such and other modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of this invention as is
15 herein defined in the appended claims.

-- CLAIMS --

1. Drying apparatus including:-
 - a drying drum rotatable about a drum axis and having a plurality of apertures formed in the drum shell whereby rotation of said drying drum about said drum axis induces an airflow through said drying drum;
 - support means for supporting said drying drum for rotation about said drum axis;
 - an access aperture formed in said drying drum, and
 - drum drive means for rotating said drying drum about said drum axis.
2. Drying apparatus as defined in Claim 1, wherein said apertures include vent apertures which extend substantially radially away from and across the outer periphery of said drying drum for inducing an air flow through said drying drum.
3. Drying apparatus as defined in Claim 2, wherein said vent apertures constitute air inlet apertures.
4. Drying apparatus as defined in any one of the preceding claims, wherein said apertures include portions of said drum shell formed of wire mesh.
5. Drying apparatus as defined in any one of the preceding claims, wherein said drum is formed substantially cylindrical.
6. Drying apparatus as defined in Claim 2, wherein said drum shell is ductile and said radially extending apertures are formed as pressed louvres having their open sides

substantially perpendicular to the direction of motion of said drying drum.

7. Drying apparatus as defined in any one of the preceding claims, wherein selected portions of said drum shell are provided with an external surface treatment or coating for enhancing its absorption of radiation.

8. Drying apparatus including:-

a support frame having a pivotal mounting formed thereon;

a drying drum supported on said pivotal mounting for rotation about a drum axis substantially coincident with the pivot axis of said pivotal mounting, said drying drum having vent portions thereof ventilated by vent apertures,

an access aperture formed in said drying drum for access therein,

and

drive means for rotating said drying drum about said pivot axis.

9. Drying apparatus as defined in Claim 8, wherein said support frame is arranged such that said drum axis is held substantially horizontal.

10. Drying apparatus as defined in Claim 8 or Claim 9, wherein said support frame includes ground-engaging legs.

11. Drying apparatus as defined in any one of Claims 8 to 10, wherein said support apparatus includes rail mounting means for mounting to a rail or balustrade.

12. Drying apparatus as defined in any one of the

preceding claims, and including forced air circulation means.

13. Drying apparatus as defined in any one of the preceding claims, and including heating means.

14. Drying apparatus as defined in any one of the preceding claims, and including access aperture closure means.

15. Drying apparatus as defined in any one of the preceding claims, wherein said drive means includes an electric motor driving the periphery of said drying drum through a friction-wheel drive.

16. A method of drying clothes including:-
providing drying apparatus having a drying drum rotatable about a drum axis and having a plurality of air inlet apertures and a plurality of air outlet apertures formed in its drum shell whereby rotation of said drying drum about said drum axis may induce airflow through said drying drum between said inlet apertures and said outlet apertures, support means for supporting said drying drum for rotation about said drum axis, and drum drive means for rotating said drying drum about said drum axis;
placing said drying apparatus in an outdoor location;
placing clothes within said drying drum,
and
operating said drive means whereby said drying drum is rotated.

17. Drying apparatus substantially as described herein with reference to the accompanying drawings.

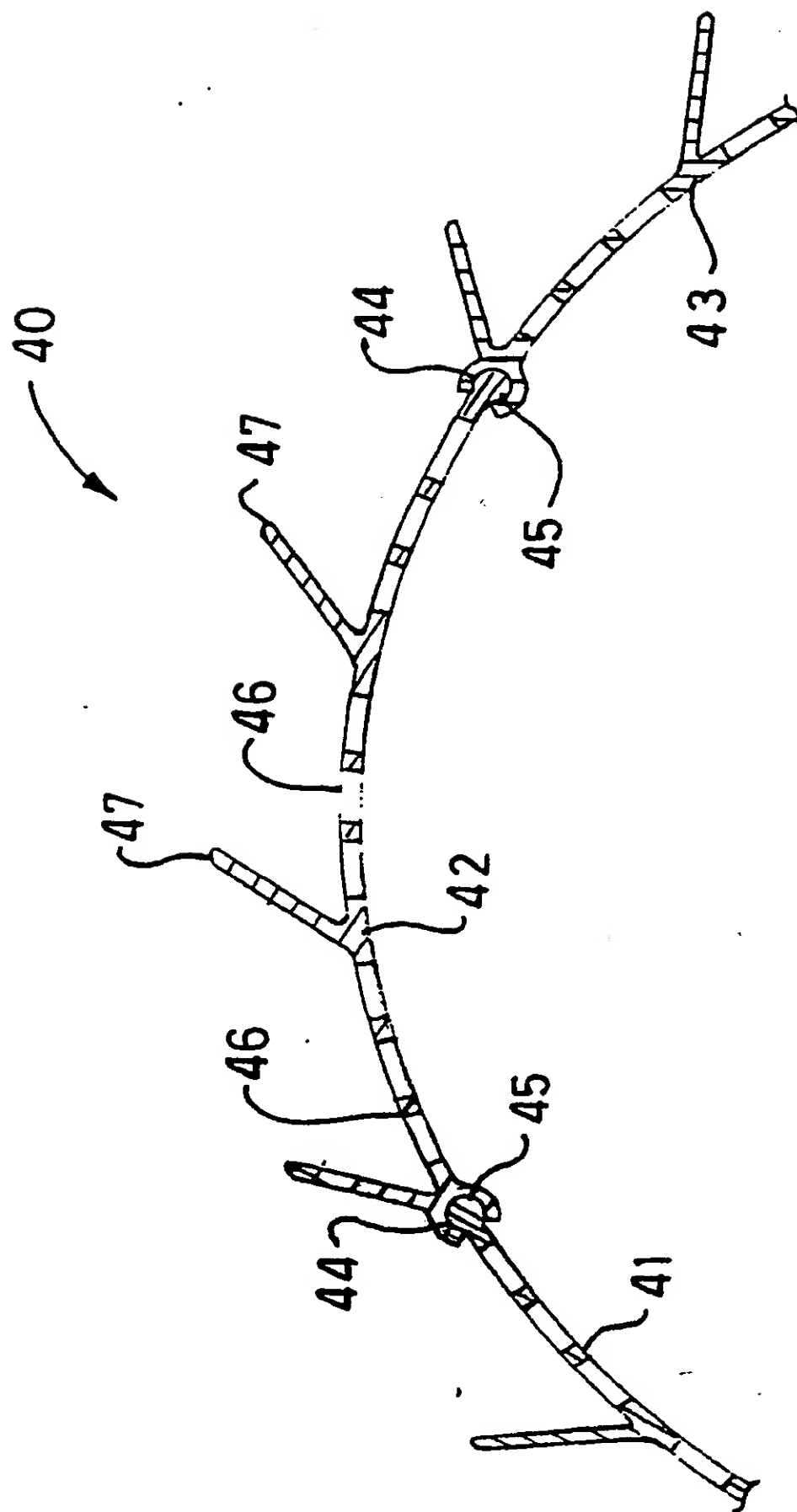


FIG. 2

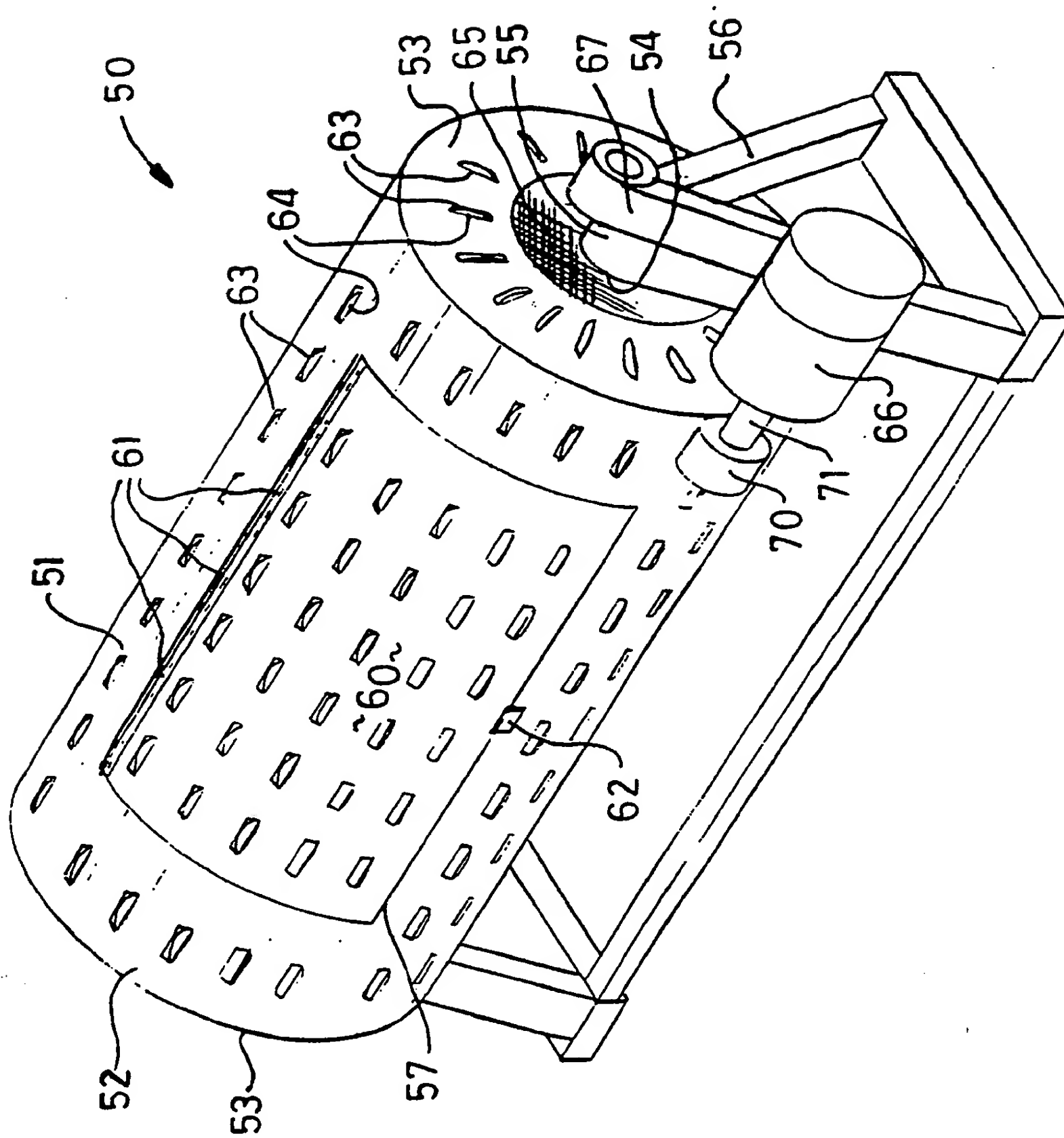


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 89/00120

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.⁴ D06F 58/00, 58/02, F26B 11/04

II. FIELDS SEARCHED

Minimum Documentation Searched *

Classification System

Classification Symbols

IPC

D06F 58/00, 58/02, F26B 11/04

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched *

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT *

Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages **	Relevant to Claim No. **
X	Patents Abstracts of Japan C 201 page 163 JP,A, 58-165734 (TAKESHI ISHIZAKA) 26 March 1982 (26.03.82)	(1-5,8-10, 13,16)
X	AU,B, 153768 (5499/51) (C.O. CURNOW) 18 September 1951 (18.09.51)	(1,8,10,16)
X	AU,B, 129543 (6477/46) (HAMILTON MANUFACTURING COMPANY) 30 October 1946 (03.10.46)	(1,8,16)

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IV. CERTIFICATION

Date of the Actual Completion of the International Search

19 May 1989 (19.05.89)

Date of Mailing of this International Search Report

29 May 1989 (29.05.89)

International Searching Authority

Australian Patent Office

Signature of Authorized Officer

C. IRWIN